

# KOE

## JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS: \_\_\_\_\_

DATE : May 31<sup>st</sup>, 2012

### CUSTOMER'S ACCEPTANCE SPECIFICATIONS

### TX48D50VM0BAA

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ACCEPTED BY: \_\_\_\_\_

PROPOSED BY: Elton Liu



## 2. RECORD OF REVISION

| DATE | SHEET No. | SUMMARY |
|------|-----------|---------|
|      |           |         |

www.panelook.com

### 3. GENERAL DATA

#### 3.1 DISPLAY FEATURES

This module is a 19" WSXGA amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R (red), G (green), B (blue) sequentially. This display is RoHS compliant, COF (chip on film) technology and LED backlight are applied on this display.

|                         |  |
|-------------------------|--|
| Part Name               | TX48D50VM0BAA  |
| Module Dimensions       | 444.0(W) mm x 300.0(H) mm x 24.0 (D) mm typ.             |
| LCD Active Area         | 409.5(W) mm x 255.9375(H) mm                             |
| Pixel Pitch             | 0.24375(W) mm x 0.24375 (H) mm                           |
| Resolution              | 1680 x 3(RGB)(W) x 1050(H) dots                          |
| Color Pixel Arrangement | R, G, B Vertical stripe                                  |
| LCD Type                | Transmissive Color TFT; Normally Black                   |
| Display Type            | Active Matrix  |
| Number of Colors        | 16.7M Colors   |
| Backlight               | Edge Light Type with White LED                           |
| Weight                  | (2000 typ). (g)  |
| Interface               | 2-Channel LVDS (LVDS:Low Voltage Differential Signaling) |
| Power Supply Voltage    | 12V for LCD; 12V for Backlight                           |
| Viewing Direction       | Super Wide Version (In-Plane Switching)                  |

### 3.2 APPLICATION AND OTHERS

- (1) This LCD module was designed and manufactured to be used in an air-conditioned room away from direct sunlight.
- (2) This LCD module cannot be applied to an instrument which requires extremely high reliability and safety from its functions and precision. These instruments include medical equipment which affects life- and/or wealth-support apparatus.
- (3) Any problems caused by a use with deviation from the conditions mentioned in this specification are not included in the warranty.
- (5) Maintenance  
This LCD module and the aforementioned data may be changed without notice. When you demand maintenance parts, please inquire about the changes in advance.
- (5) Repair  
We will replace or repair all defective modules if the relevant defect is caused by KOE. However, we will not take any responsibilities for defective modules after the expiration of warranty period. Also, if you access the modules for repairs, we will not warrant them either even if it is within the warranty period.
- (6) Items in this specification may be changed for improvement without prior notice. Please consult our sales division before engineering an instrument with this LCD module.
- (7) When a question arises concerning the specification, please contact our sales division.

## 4. ABSOLUTE MAXIMUM RATINGS

| Item                    | Symbol | Min. | Max. | Unit | Remarks |
|-------------------------|--------|------|------|------|---------|
| Supply Voltage          | VDD    | 0    | 13.5 | V    | -       |
| Input Voltage of Logic  | VI     | -0.3 | 3.6  | V    | Note 1  |
| Operating Temperature   | Top    | 0    | 50   | °C   | Note 2  |
| Storage Temperature     | Tst    | -20  | 60   | °C   | Note 2  |
| Backlight Input Voltage | VLED   | -    | (15) | V    | -       |

Note 1: The rating is defined for the signal voltages of the interface such as DCLK, DTMG, and RGB data bus.

Note 2: The maximum rating is defined as above based on the chamber temperature, which might be different from ambient temperature after assembling the panel into the application. Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25°C.
- Operating under high temperature will shorten LED lifetime.

## 5. ELECTRICAL CHARACTERISTICS

### 5.1 LCD CHARACTERISTICS

 $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{SS} = 0\text{V}$ 

| Item                   | Symbol    | Min. | Typ. | Max. | Unit | Remarks |
|------------------------|-----------|------|------|------|------|---------|
| Power Supply Voltage   | VDD       | 11.4 | 12.0 | 12.6 | V    | -       |
| Input Voltage of Logic | VI        | -0.3 | -    | 3.6  | V    | Note 1  |
| Power Supply Current   | IDD       | -    | 500  | 800  | mA   | Note 2  |
| Vsync Frequency        | $f_v$     | 50   | 60   | 60   | Hz   | -       |
| Hsync Frequency        | $f_H$     | 52.7 | 63.2 | 66   | KHz  | -       |
| CLK Frequency          | $f_{CLK}$ | 51.7 | 62   | 69.3 | MHz  | -       |

Note 1: The rating is defined for the signal voltages of the interface such as DTMG, DCLK and RGB data bus.

Note 2: An all white check pattern is used when measuring IDD.  $f_v$  is set to 60 Hz.

Note 3: 1.0A fuse is applied in the module for IDD. For display activation and protection purpose, power supply is recommended larger than 5.0A to start the display and break fuse once any short circuit occurred.

### 5.2 BACKLIGHT CHARACTERISTICS

 $T_a = 25\text{ }^\circ\text{C}$ 

| Item                             | Symbol | Min.   | Typ.   | Max. | Unit | Remarks  |         |
|----------------------------------|--------|--------|--------|------|------|----------|---------|
| Input Voltage                    | Vin    | 10.8   | 12.0   | 13.2 | V    | -        |         |
| Input Current                    | lin    | -      | (1.46) | -    | A    | -        |         |
| ON/OFF Control Voltage           | ON     | ON/OFF | 2.5    | -    | 5.0  | V        | B/L=ON  |
|                                  | OFF    |        | 0      | -    | 0.8  | V        | B/L=OFF |
| Brightness Control Voltage       | Vbc    | 1.0    | -      | 3.6  | V    | Note 1,2 |         |
| PWM dimming signal Input Voltage | PWM    | High   | 2.9    | -    | 5.0  | V        | Note 3  |
|                                  |        | Low    | 0      | -    | 0.8  | V        | -       |
| PWM Frequency                    | PWMf   | 140    | 150    | 160  | Hz   | -        |         |

Note 1: As for Vbc, it is recommendable to use more than 1.0V.

If Vbc is set less than 1.0V in which brightness becomes less than 20% to the maximum, display image may look unstable since relative change of brightness tends to become large by the slight drift of Vbc.

Note 2: Brightness rises almost linearly by increasing the Vbc in less than 3.0V.

However, brightness is saturated when Vbc exceeds 3.0V.

Note 3: Brightness is almost proportional to the on-Duty ratio of PWM signal input.

## 6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25 °C, VDD=12.0V, fv=60Hz.
- In the dark room around 500~1000 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$$T_a = 25\text{ }^{\circ}\text{C}, f_v = 60\text{ Hz}, VDD = 12V$$

| Item                  | Symbol | Condition  | Min.                 | Typ.  | Max.  | Unit              | Remarks  |        |
|-----------------------|--------|--|----------------------|-------|-------|-------------------|----------|--------|
| Brightness of White   | -      | $\theta = 0^{\circ}$   | 280                  | 350   | -     | cd/m <sup>2</sup> | Note 1,2 |        |
| Brightness Uniformity | -      |  | 70                   | -     | -     | %                 | Note 3   |        |
| Contrast Ratio        | CR     |  | 600                  | 900   | -     | -                 | Note 4   |        |
| Response Time         | Rise   | ton  | -                    | 12.7  | 21.9  | ms                | Note 5   |        |
|                       | Fall   | toff   | -                    | 11.5  | 20.7  |                   |          |        |
| Color Chromaticity    | Red    | X  | $\theta = 0^{\circ}$ | 0.614 | 0.644 | 0.674             | -        | Note 6 |
|                       |        | Y  |                      | 0.307 | 0.337 | 0.367             |          |        |
|                       | Green  | X  |                      | 0.306 | 0.336 | 0.366             |          |        |
|                       |        | Y  |                      | 0.583 | 0.613 | 0.643             |          |        |
|                       | Blue   | X  |                      | 0.116 | 0.146 | 0.176             |          |        |
|                       |        | Y  |                      | 0.015 | 0.045 | 0.075             |          |        |
|                       | White  | X  |                      | 0.283 | 0.313 | 0.343             |          |        |
|                       |        | Y  |                      | 0.299 | 0.329 | 0.359             |          |        |
| Contrast Ratio at 85° | CR 85° | $\theta = 85^{\circ}$<br>$\phi = 0^{\circ}, 90^{\circ},$<br>$180^{\circ}, 270^{\circ}$ | 10                   | -     | -     | -                 | -        |        |
| NTSC Ratio            |        | $\theta = 0^{\circ}$   | -                    | 72    | -     | %                 | -        |        |

Note 1: The brightness is measured from the panel center point, P5 in Fig. 6.2, for the typical value.

Note 2: Brightness of white is measured by LCM is light up after 30 minutes .

Note 3: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

, which is based on the brightness values of the 9 points measured by CS-1000A as shown in Fig. 6.2.

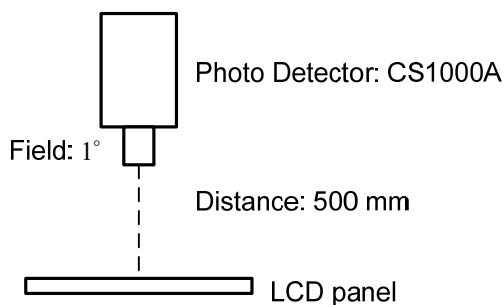


Fig. 6.1

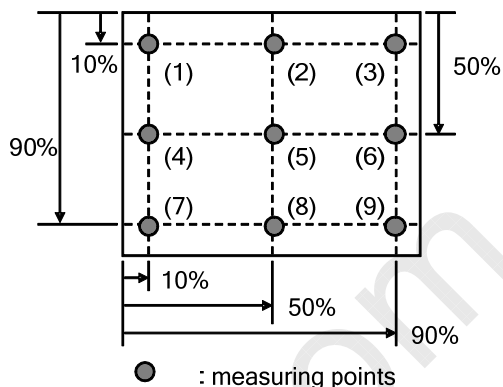


Fig. 6.2

Note 4: The Contrast Ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 5: The definition of response time is shown in Fig. 6.3. The rising time is the period from 10% brightness to 90% brightness when the data is from black to white. Oppositely, Falling time is the period from 90% brightness rising to 10% brightness.

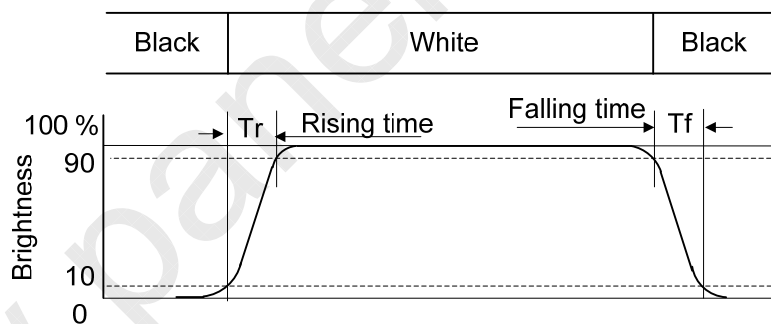


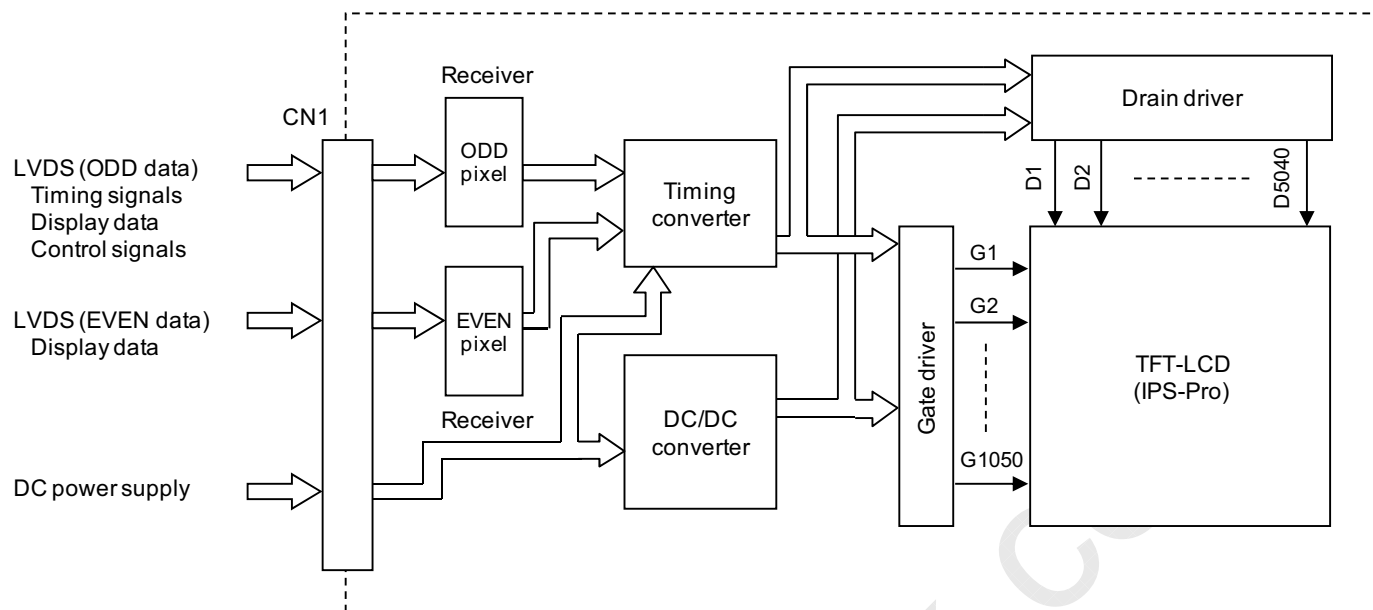
Fig 6.3

Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

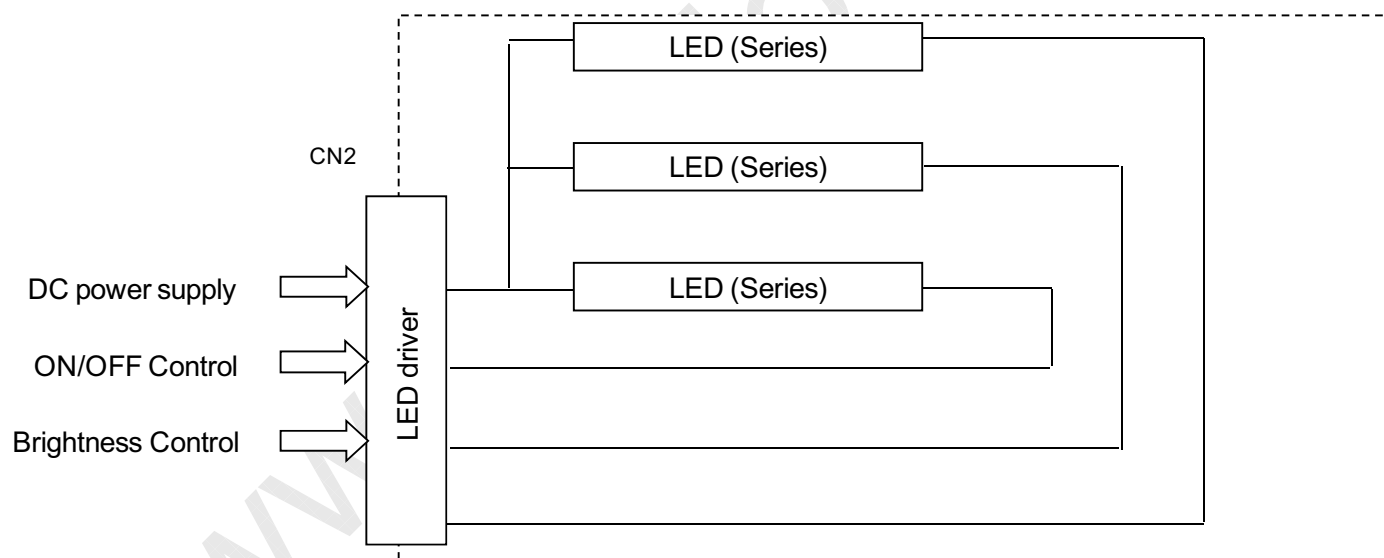


## 7. BLOCK DIAGRAM

### 7.1 TFT Module



### 7.2 Back light unit



## 8. INTERFACE PIN ASSIGNMENT

### 8.1 TFT-LCD MODULE

The display interface connector (CN1) is MDF76GW-30S-1H (HIROSE), and Pin assignment is as below:

(Matching connector: JAE FI-X30H or FI-X30M or Equivalent )

| Pin No. | Symbol   | Function           | Note |
|---------|----------|--------------------|------|
| 1       | RAIN0-   | ODD pixel data     | 2)   |
| 2       | RAIN0+   |                    |      |
| 3       | RAIN1-   | ODD pixel data     | 2)   |
| 4       | RAIN1+   |                    |      |
| 5       | RAIN2-   | ODD pixel data     | 2)   |
| 6       | RAIN2+   |                    |      |
| 7       | VSS      | GND (0V)           | 1)   |
| 8       | RACLKIN- | ODD pixel clock    | 2)   |
| 9       | RACLKIN+ |                    |      |
| 10      | RAIN3-   | ODD pixel data     | 2)   |
| 11      | RAIN3+   |                    |      |
| 12      | RBIN0-   | EVEN pixel data    | 2)   |
| 13      | RBIN0+   |                    |      |
| 14      | VSS      | GND (0V)           | 1)   |
| 15      | RBIN1-   | EVEN pixel data    | 2)   |
| 16      | RBIN1+   |                    |      |
| 17      | VSS      | GND (0V)           | 1)   |
| 18      | RBIN2-   | EVEN pixel data    | 2)   |
| 19      | RBIN2+   |                    |      |
| 20      | RBCLKIN- | EVEN pixel clock   | 2)   |
| 21      | RBCLKIN+ |                    |      |
| 22      | RBIN3-   | EVEN pixel data    | 2)   |
| 23      | RBIN3+   |                    |      |
| 24      | VSS      | GND (0V)           | 1)   |
| 25      | NC       | No Connection      | 3)   |
| 26      | DE       | No Connection      | 3)   |
| 27      | NC       | No Connection      | 3)   |
| 28      | VDD      | Power Supply (12V) | 4)   |
| 29      | VDD      |                    |      |
| 30      | VDD      |                    |      |

Notes 1) All Vss pins should be grounded.

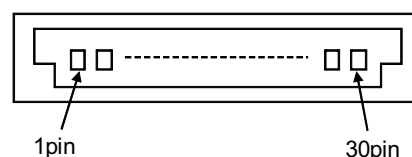
2) RnINm+ and RnINm- (n=A,B m=0,1,2,3) should be wired by twist-pairs

or side-by-side FPC patterns, respectively.

3) Please keep open.

4) All VDD pins should be connected to +12.0 V (typ.).

5) Pin assignment is as follows.



(Figure from top-view)

## 8.2 BACK-LIGHT UNIT

The backlight connector (CN2) is TARNG YU Enterprise TU2001WNR-12S, and pin assignment is as below:

(Matching connector : JST PHR-12 or TARNG YU Enterprise TU2001HNO-12)

| Pin No. | Symbol | Description                              | Note  |
|---------|--------|--|-------|
| 1       | VIN    | Power Supply (typ. 12.0V)                | 1)    |
| 2       | VIN    |  |       |
| 3       | VIN    |  |       |
| 4       | VIN    |  |       |
| 5       | ON/OFF | High : Backlight ON, Low : Backlight OFF | 4)    |
| 6       | VSS    | GND (0V)                                 | 2)    |
| 7       | VSS    |  |       |
| 8       | VBC    | Brightness Control Signal                | 5),6) |
| 9       | PWM    | PWM Dimming Signal                       | 3),6) |
| 10      | FLT    | LED Fault Signal                         | 7)    |
| 11      | VSS    | GND (0V)                                 | 2)    |
| 12      | VSS    |  |       |

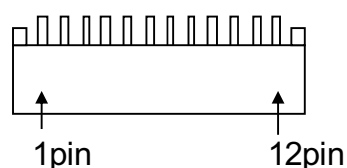
### Notes

- VIN pins should be connected to +12.0V (Typ.).
- VSS pins should be grounded. The metal bezel is internally connected to GND.
- High level:2.5~5.0V, Low level:0~0.8V
- High level:2.5~5.0V, Low level:0~0.8V
- Input Voltage : 1.0 ~ 3.6V DC (Brightness becomes maximum at 3.3 +/- 0.3V.)
- These signals should not be inputted simultaneously. i.e.  
when the PWM signal is to be inputted, please set the terminal of VBC to NC. Or  
when the VBC signal is to be inputted, please set the PWM terminal to NC.
- Depending on the state of the LED string, the following voltage is output.

| Voltage Level | Condition                | Definition  |
|---------------|--------------------------|---|
| 2.1~3.3V      | Normal Operation         | -   |
| 0~0.8V        | LED String Open Circuit  | One or more strings are occurred open circuit.                              |
|               | LED String Short Circuit | One or more strings are occurred short circuit between string+ and string-. |

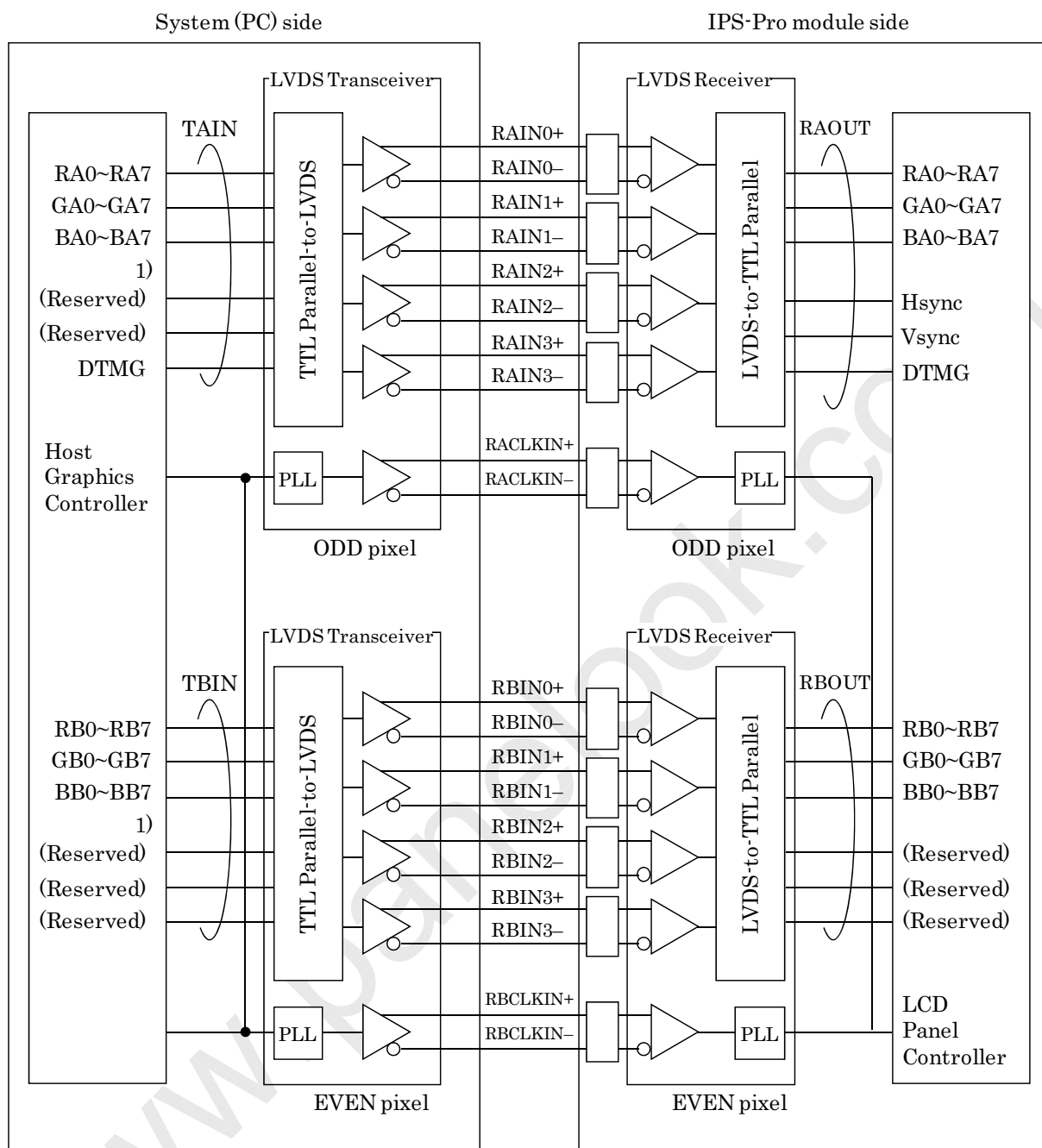
If this is not used in particular, please set the terminal of FLT to NC(No Connection).

- Pin assignment is as follows.



(Figure from top-view)

## 8.3 BLOCK DIAGRAM OF INTERFACE



RA0~7, RB0~7 : R data

GA0~7, GB0~7 : G data

BA0~7, BB0~7 : B data

DTMG : Display timing data

Receiver: Equivalent of THC63LVDF84B by Thine

Notes 1) RSVD (reserved) pins on a transmitter should be connected with Vss.

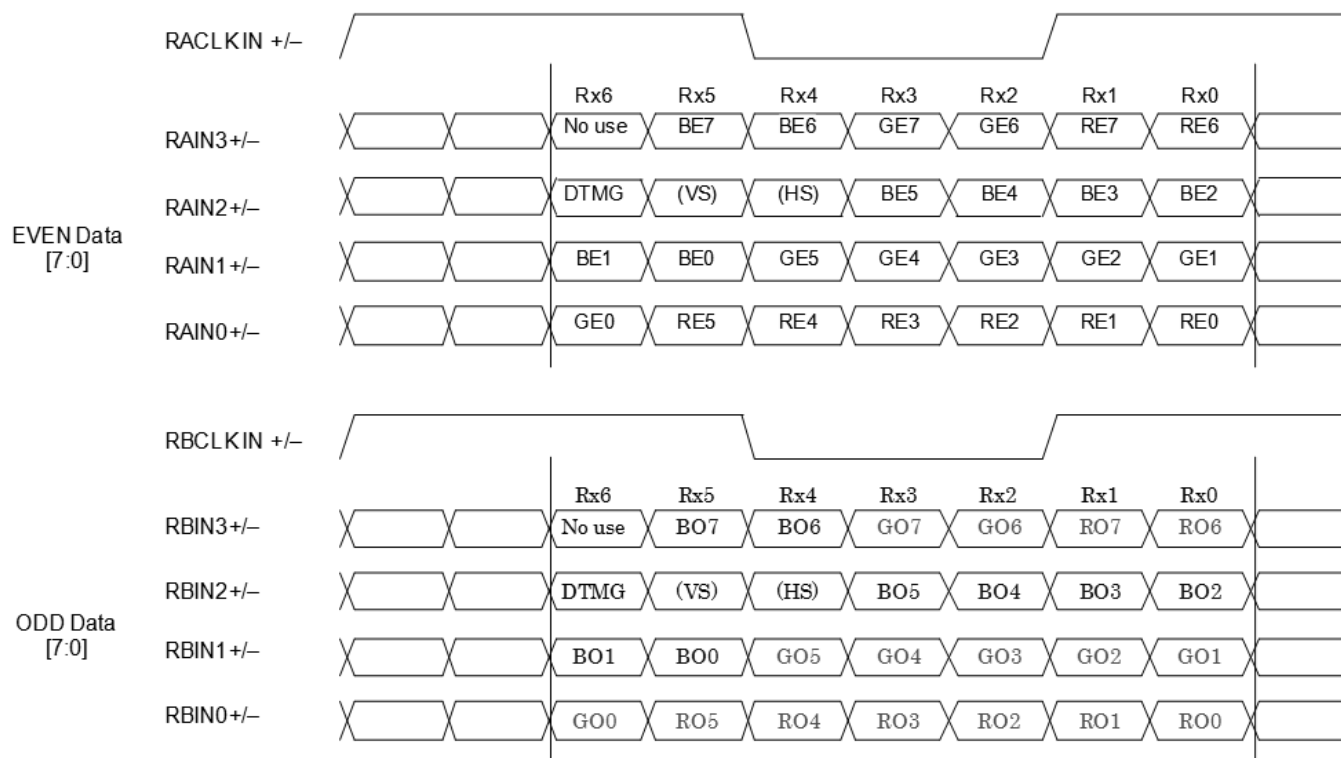
2) The system must have a LVDS transmitter to drive a module.

Moreover, each channel must have a DTMG signal.

3) The impedance of LVDS cable should be 50 ohms per a signal line or about 100 ohms per a twist-pair line when it is used differentially.

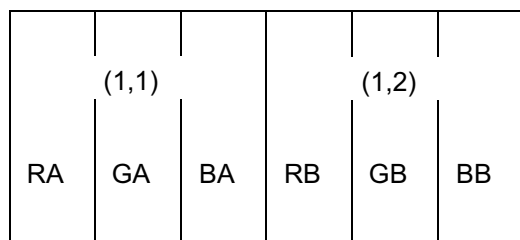
### 8.4 LVDS INTERFACE

**8bit Digital**



**8 bit x 3 LVDS Interface Format**

## 8.5 CORRESPONDENCE BETWEEN INPUT DATA AND DISPLAY IMAGE



ODD pixel : RA0~RA7 : R data

GA0~GA7 : G data

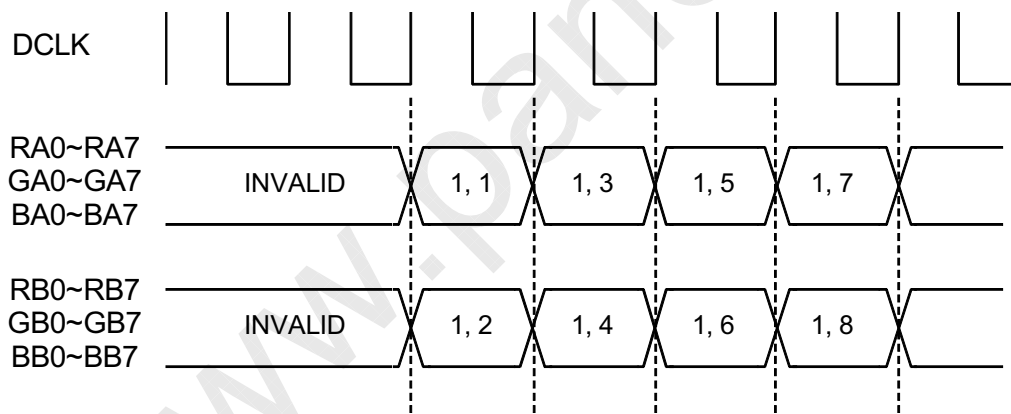
BA0~BA7 : B data

EVEN pixel : RB0~RB7 : R data

GB0~GB7 : G data

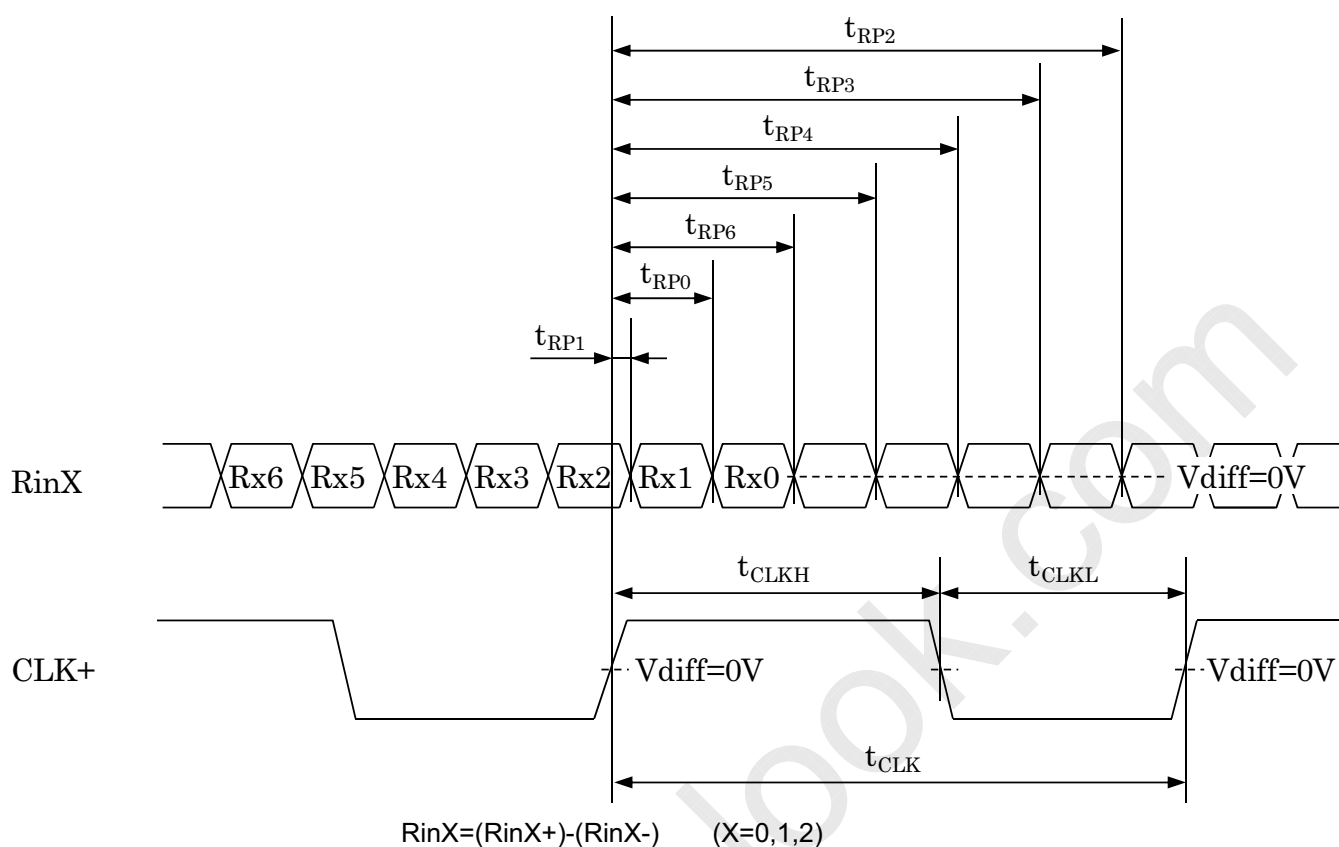
BB0~BB7 : B data

|        |        |        |       |           |
|--------|--------|--------|-------|-----------|
| 1,1    | 1,2    | 1,3    | ..... | 1,1680    |
| 2,1    | 2,2    | 2,3    | ..... | 2,1680    |
| 3,1    | 3,2    | 3,3    | ..... | 3,1680    |
| ⋮      | ⋮      | ⋮      |       | ⋮         |
| 1050,1 | 1050,2 | 1050,3 | ..... | 1050,1680 |



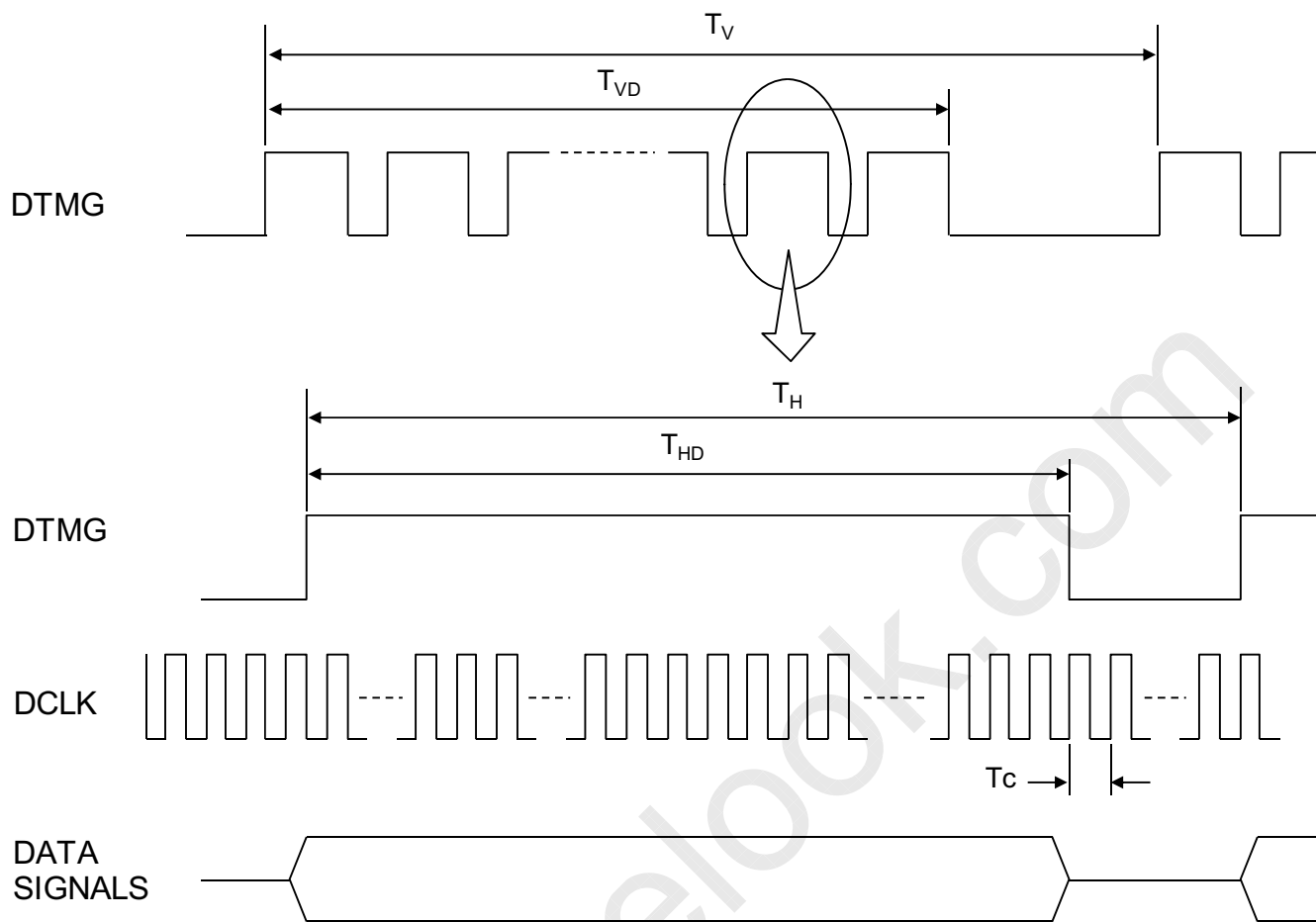
## 9. TIMING CHART

### 9.1 RECEIVER INPUT DATA POSITION



|                   | Item                       | Symbol      | Min.              | Typ.         | Max.              | Unit | Note |
|-------------------|----------------------------|-------------|-------------------|--------------|-------------------|------|------|
| CLK+              | Input CLK frequency        | $1/t_{CLK}$ | 51.7              | 62.0         | 69.3              | MHz  |      |
|                   | Differential CLK High Time | $t_{CLKH}$  | —                 | $4/7t_{CLK}$ | —                 | ns   |      |
|                   | Differential CLK Low Time  | $t_{CLKL}$  | —                 | $3/7t_{CLK}$ | —                 |      |      |
| RinX<br>(X=0,1,2) | 0 data position            | $t_{RP0}$   | $1/7t_{CLK}-0.41$ | $1/7t_{CLK}$ | $1/7t_{CLK}+0.41$ | ns   |      |
|                   | 1st data position          | $t_{RP1}$   | -0.41             | 0            | +0.41             |      |      |
|                   | 2nd data position          | $t_{RP2}$   | $6/7t_{CLK}-0.41$ | $6/7t_{CLK}$ | $6/7t_{CLK}+0.41$ |      |      |
|                   | 3rd data position          | $t_{RP3}$   | $5/7t_{CLK}-0.41$ | $5/7t_{CLK}$ | $5/7t_{CLK}+0.41$ |      |      |
|                   | 4th data position          | $t_{RP4}$   | $4/7t_{CLK}-0.41$ | $4/7t_{CLK}$ | $4/7t_{CLK}+0.41$ |      |      |
|                   | 5th data position          | $t_{RP5}$   | $3/7t_{CLK}-0.41$ | $3/7t_{CLK}$ | $3/7t_{CLK}+0.41$ |      |      |
|                   | 6th data position          | $t_{RP6}$   | $2/7t_{CLK}-0.41$ | $2/7t_{CLK}$ | $2/7t_{CLK}+0.41$ |      |      |

## 9.2 TIMING CONVERTER SIGNAL TIMING

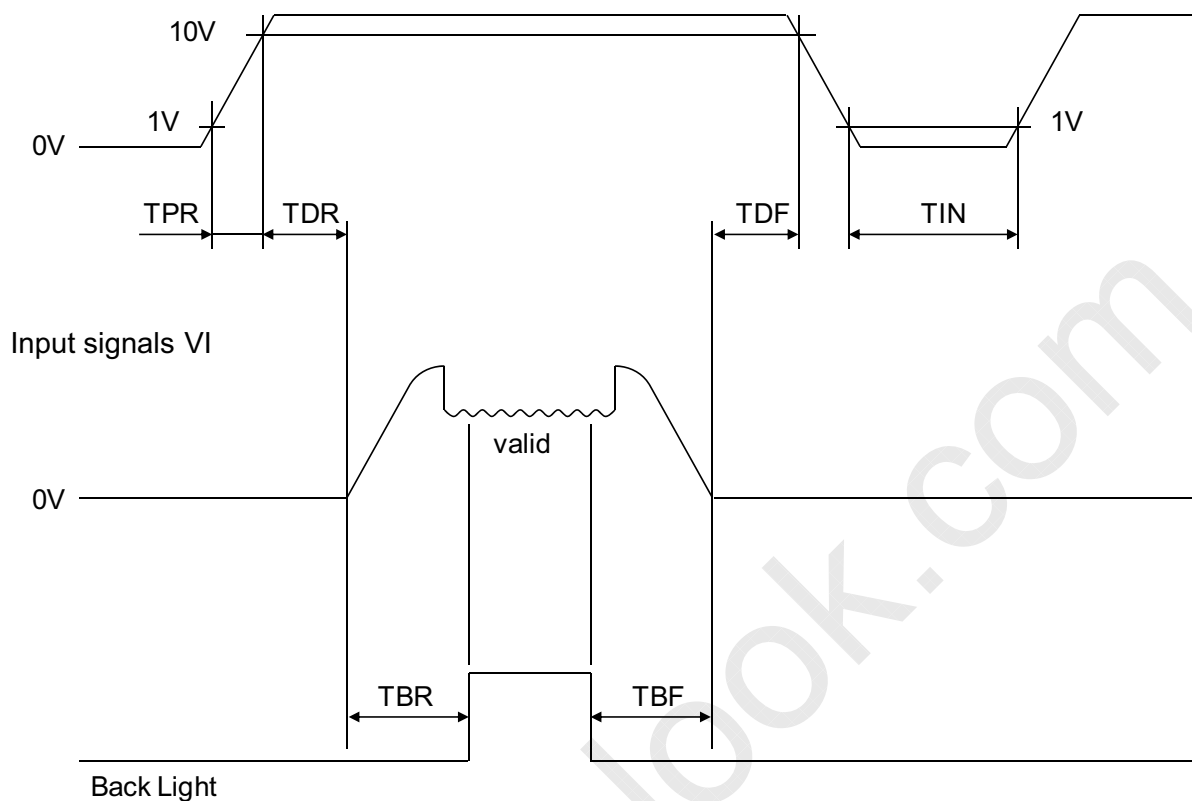


| Item |                         | Symbol   | Min. | Typ. | Max. | Unit  | Note |
|------|-------------------------|----------|------|------|------|-------|------|
| DCLK | Cycle time              | $T_C$    | 14.4 | 16.1 | 19.3 | ns    |      |
| DTMG | Horizontal period       | $T_H$    | 980  | 980  | 1050 | $T_C$ |      |
|      | Horizontal width-Active | $T_{HD}$ | 840  | 840  | 840  | $T_C$ |      |
|      | Vertical period         | $T_V$    | 1054 | 1054 | 1100 | $T_H$ |      |
|      | Vertical width-Active   | $T_{VD}$ | 1050 | 1050 | 1050 | $T_H$ |      |
|      | Frame frequency         | $f_V$    | 50   | 60   | 60   | Hz    |      |



### 9.3 POWER SEQUENCE

Power supply voltage VDD



Timing of power supply voltage and input signals should be used under the following specifications.

|      |   |     |   |       |
|------|---|-----|---|-------|
| 0ms  | ≧ | TPR | ≧ | 10ms  |
| 10ms | ≧ | TDR | ≧ | 50ms  |
| 0ms  | ≧ | TDF | ≧ | 50ms  |
|      |   | TIN | ≧ | 1s    |
|      |   | TBR | ≧ | 500ms |
|      |   | TBF | ≧ | 100ms |

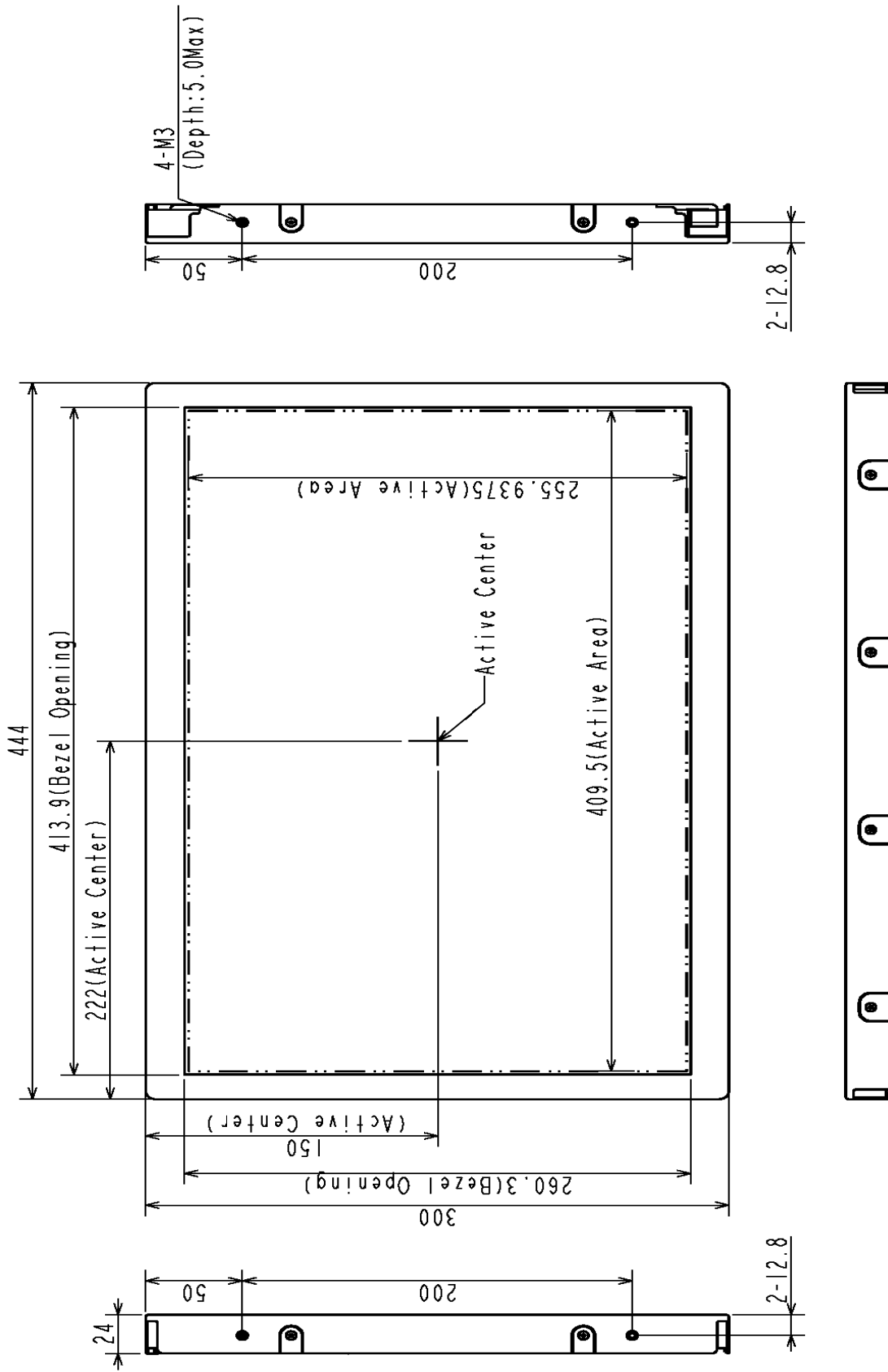
### 9.4 DATA INPUT for DISPLAY COLOR

| Input data  |             | R data |     |     |     |     |     |     |     | G data |     |     |     |     |     |     |     | B data |     |     |     |     |     |     |     |
|-------------|-------------|--------|-----|-----|-----|-----|-----|-----|-----|--------|-----|-----|-----|-----|-----|-----|-----|--------|-----|-----|-----|-----|-----|-----|-----|
|             |             | RA7    | RA6 | RA5 | RA4 | RA3 | RA2 | RA1 | RA0 | GA7    | GA6 | GA5 | GA4 | GA3 | GA2 | GA1 | GA0 | BA7    | BA6 | BA5 | BA4 | BA3 | BA2 | BA1 | BA0 |
|             |             | RB7    | RB6 | RB5 | RB4 | RB3 | RB2 | RB1 | RB0 | GB7    | GB6 | GB5 | GB4 | GB3 | GB2 | GB1 | GB0 | BB7    | BB6 | BB5 | BB4 | BB3 | BB2 | BB1 | BB0 |
|             |             | MSB    |     |     |     | LSB |     |     |     | MSB    |     |     |     | LSB |     |     |     | MSB    |     |     |     | LSB |     |     |     |
| BASIC COLOR | BLACK       | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | RED (255)   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | GREEN (255) | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | BLUE (255)  | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
|             | CYAN        | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
|             | MAGENTA     | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
|             | YELLOW      | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | WHITE       | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   |
| RED         | BLACK       | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | RED (1)     | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | RED (2)     | 0      | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | ⋮           | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   |
|             | ⋮           | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   |
|             | RED (254)   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | RED (255)   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| GREEN       | BLACK       | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | GREEN (1)   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | GREEN (2)   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | ⋮           | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   |
|             | ⋮           | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   |
|             | GREEN (254) | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | GREEN (255) | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| BLUE        | BLACK       | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
|             | BLUE (1)    | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 1   |
|             | BLUE (2)    | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 1   | 0   |
|             | ⋮           | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   |
|             | ⋮           | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮      | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   | ⋮   |
|             | BLUE (254)  | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 0   |
|             | BLUE (255)  | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1      | 1   | 1   | 1   | 1   | 1   | 1   | 1   |

Notes 1) Definition of gray scale: Color (n)  
 n indicates gray scale level. Higher n means brighter level.  
 2) Data signals: 1: High, 0: Low

## 10. OUTLINE DIMENSIONS

### 10.1 FRONT VIEW



Note 1) Dimension in parentheses are reference value.  
 Tolerance not specified is  $\pm 1.0$ mm.  
 Maximum torque for M3 screw: 0.588N-m.

Unit:mm  
 Scale:NTS

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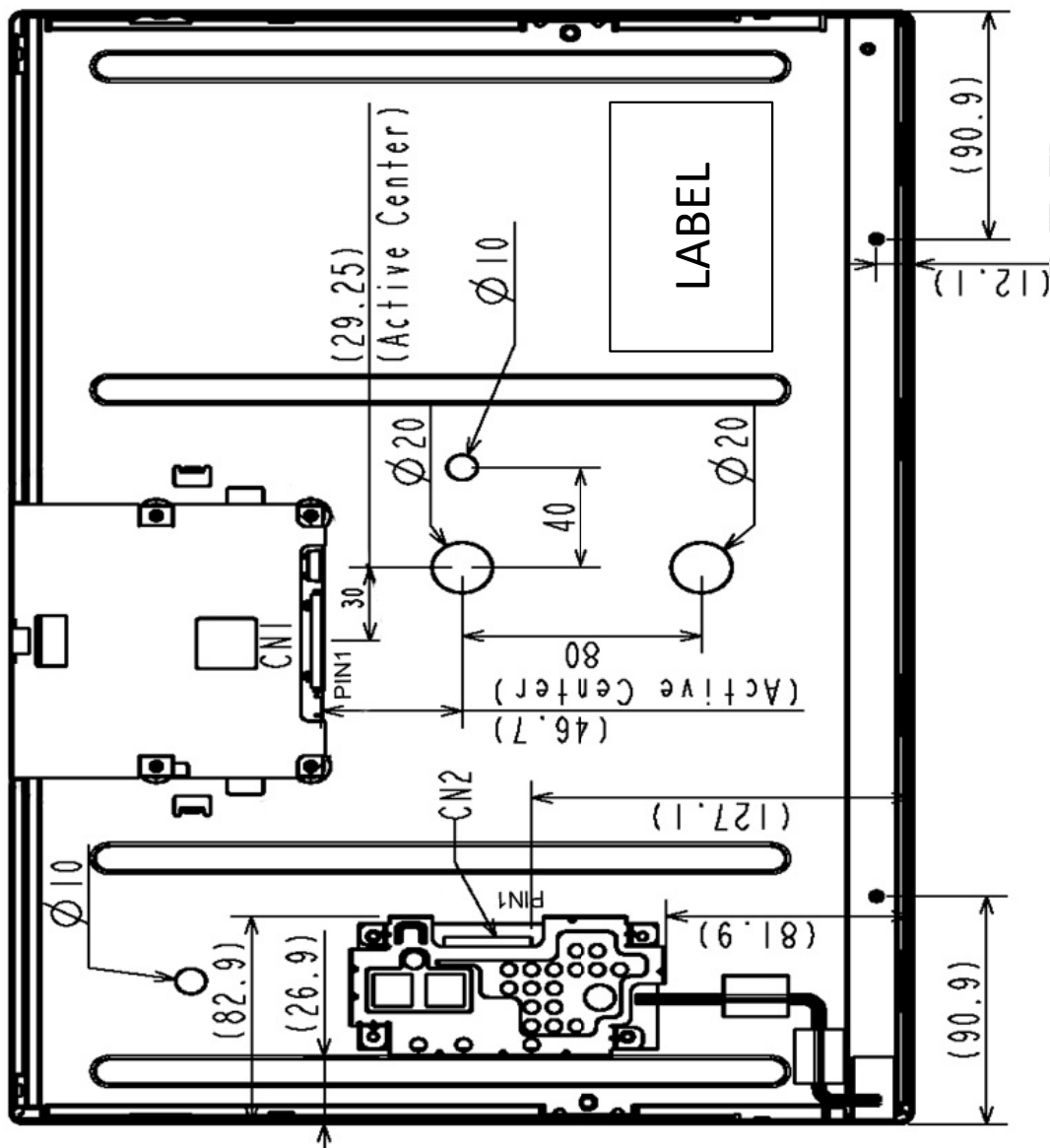
SHEET  
 No.

7B64PS 2710-TX48D50VM0BAA-1

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## 10.2 FRAR VIEW



- Note
- 1) Dimension in parentheses are reference value.
  - 2) Tolerance not specified is +/- 1.0mm.
  - 3) The Position of the LED bar fixation screws.

Unit:mm  
Scale:NTS

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## 11. APPEARANCE STANDARD

### 11.1 CONDITIONS FOR COSMETIC INSPECTION

#### (1) Viewing zone

a) The figure shows the correspondence

between eyes (of inspector) and

TFT-LCD module.

$\theta < 45^\circ$  : when non-operating inspection

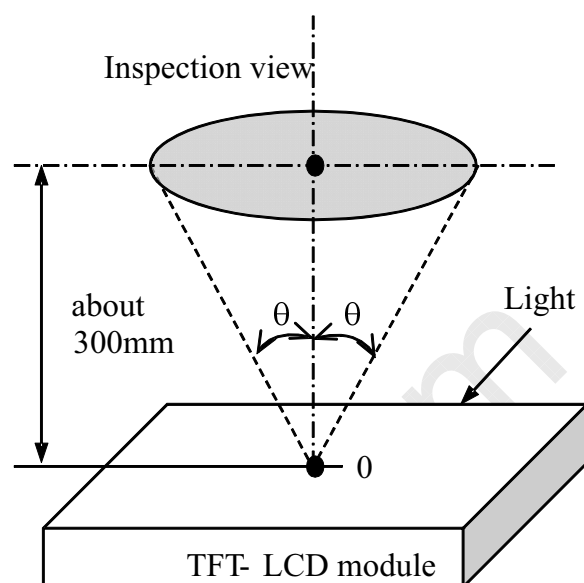
$\theta < 5^\circ$  : when operating inspection

b) Inspection should be executed only from

front side and only A-zone.

Cosmetic of B-zone and C-zone are ignore.

(refer to 9.2 DEFINITION OF ZONE)



#### (2) Environmental

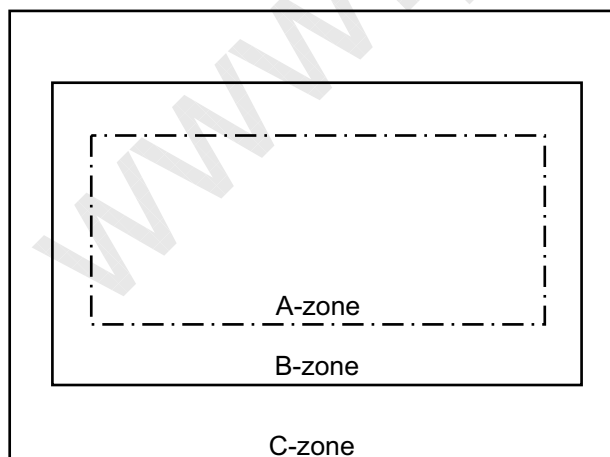
a) Temperature : 25°C

b) Ambient light : about 700 lx and non-directive when operating inspection.

: about 1000 lx and non-directive when non-operating inspection.

c) Back-light : when non-operating inspection, back-light should be off.

### 11.2 DEFINITION OF ZONE



A-zone : Display area (pixel area).

B-zone : Area between A-zone and C-zone.

C-zone : Metal bezel area.

(Include I/F connector)

## 11.2 LCD APPEARANCE SPECIFICATION

The specification as below is defined as the amount of unexpected phenomenon or material in different zones of LCD panel. The definitions of length, width and average diameter using in the table are shown in Fig. 11.3 and Fig. 11.4.

| Item  | Criteria                              |                            |                |               | Applied zone |
|---|---------------------------------------|----------------------------|----------------|---------------|--------------|
|   | Length (mm)                           | Width (mm)                 | Maximum number | Minimum space |              |
| Scratches   | Ignored                               | $W \leq 0.02$              | Ignored        | -             | A,B          |
|   | $L \leq 40$                           | $W \leq 0.04$              | 10             | -             |              |
|   | $L \leq 20$                           | $W \leq 0.08$              | 10             | -             |              |
|   | Round (Dot Shape)                     |                            |                |               |              |
|   | Average diameter (mm)                 |                            | Maximum number | Minimum space |              |
|   | $D \leq 0.2$                          |                            | Ignore         | -             |              |
|   | $D \leq 0.6$                          |                            | 10             | -             |              |
|   | Dent                                  | Serious one is not allowed |                |               |              |
| Wrinkles in polarizer                             | Serious one is not allowed            |                            |                |               | A            |
| Bubbles on polarizer                              | Average diameter (mm)                 |                            | Maximum number |               | A            |
|   | $D \leq 0.3$                          |                            | Ignored        |               |              |
|   | $0.3 < D \leq 0.5$                    |                            | 10             |               |              |
|   | $0.5 < D \leq 1.0$                    |                            | 5              |               |              |
|   | $1.0 < D$                             |                            | none           |               |              |
| 1) Stains<br>2) Foreign Materials<br>3) Dark Spot | Filamentous (Line shape)              |                            |                |               | A,B          |
|   | Length (mm)                           | Width (mm)                 | Maximum number |               |              |
|   | -                                     | $W \leq 0.02$              | Ignored        |               |              |
|   | $L \leq 4.0$                          | $W \leq 0.04$              | 8              |               |              |
|   | $L \leq 2.0$                          | $W \leq 0.08$              | 8              |               |              |
|   | -                                     | $W > 0.08$                 | Dot Shape      |               |              |
|   | Round (Dot shape)                     |                            |                |               | A,B          |
|   | Average diameter (mm)                 |                            | Maximum number | -             |              |
|   | $D \leq 0.22$                         |                            | Ignored        | -             |              |
|   | $D \leq 0.5$                          |                            | 8              | -             |              |
|   | $D > 0.5$                             |                            | None           | -             |              |
|   | Those wiped out easily are acceptable |                            |                |               |              |
|   | Dot-Defect<br>(Note 1)                |                            |                | Type          |              |
| Bright dot-defect                                 |                                       | 1 dot                      | 5              |               |              |
|   |                                       | 2 adjacent dot             | 2              |               |              |
|   |                                       | 3 adjacent dot or above    | Not allowed    |               |              |
|   |                                       | In total                   | 5              |               |              |
| Dark dot-defect                                   |                                       | 1 dot                      | 8              |               |              |
|   |                                       | 2 adjacent dot             | 4              |               |              |
|   |                                       | 3 adjacent dot or above    | Not allowed    |               |              |
|   |                                       | In total                   | 8              |               |              |
| In total  |                                       |                            | 13             |               |              |

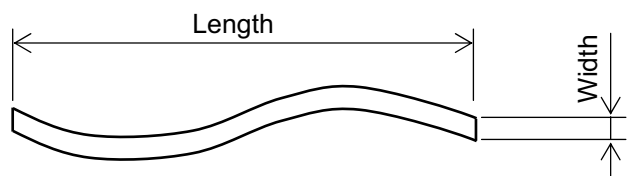


Fig 11.3

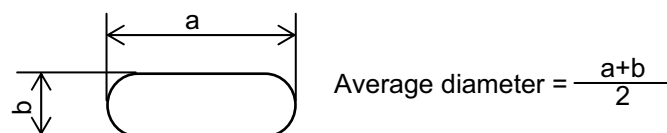


Fig 11.4

Note 1: The definitions of dot defect are as below:

- The defect area of the dot must be bigger than half of a dot.
- For bright dot-defect, showing black pattern, the dot's brightness must be over 30% brighter than others.
- For dark dot-defect, showing white pattern, the dot's brightness must be under 70% darker than others.
- The definition of 1-dot-defect is the defect-dot, which is isolated and no adjacent defect-dot.
- The definition of adjacent dot is shown as Fig. 11.5.
- The Density of dot defect is defined in the area within diameter  $\phi = 20\text{mm}$ .

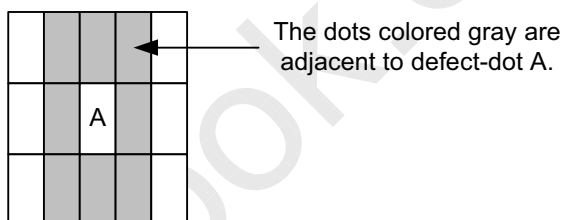


Fig 11.5

Note 2: Polarizer area inside of B-Zone is not applied.

## 12. PRECAUTIONS

### 12.1 PRECAUTIONS OF ESD

- 1) Before handling the display, please ensure your body has been connected to ground to avoid any damages by ESD. Also, do not touch display's interface directly when assembling.
- 2) Please remove the protection film very slowly before turning on the display to avoid generating ESD.

### 12.2 PRECAUTIONS OF HANDLING

- 1) In order to keep the appearance of display in good condition, please do not rub any surfaces of the displays by sharp tools harder than 3H, especially touch panel, metal frame and polarizer.
- 2) Please do not pile the displays in order to avoid any scars leaving on the display. In order to avoid any injuries, please pay more attention for the edges of glasses and metal frame, and wear finger cots to protect yourself and the display before working on it.
- 3) Touching the display area or the terminal pins with bare hand is prohibited. This is because it will stain the display area and cause poor insulation between terminal pins, and might affect display's electrical characteristics furthermore.
- 4) Do not use any harmful chemicals such as acetone, toluene, and isopropyl alcohol to clean display's surfaces.
- 5) Please use soft cloth or absorbent cotton with ethanol to clean the display by gently wiping. Moreover, when wiping the display, please wipe it by horizontal or vertical direction instead of circling to prevent leaving scars on the display's surface, especially polarizer.
- 6) Please wipe any unknown liquids immediately such as saliva, water or dew on the display to avoid color fading or any permanently damages.
- 7) Maximum pressure to the surface of the display must be less than  $1.96 \times 10^4$  Pa. If the area of adding pressure is less than  $1 \text{ cm}^2$ , the maximum pressure must be less than 1.96N.

### 12.3 PRECAUTIONS OF OPERATING

- 1) Please input signals and voltages to the displays according to the values defined in the section of electrical characteristics to obtain the best performance. Any voltages over than absolute maximum rating will cause permanent damages to this display. Also, any timing of the signals out of this specification would cause unexpected performance.
- 2) When the display is operating at significant low temperature, the response time will be slower than it at  $25 \text{ C}^\circ$ . In high temperature, the color will be slightly dark and blue compared to original pattern. However, these are temperature-related phenomenon of LCD and it will not cause permanent damages to the display when used within the operating temperature.
- 3) The use of screen saver or sleep mode is recommended when static images are likely for long periods of time. This is to avoid the possibility of image sticking.
- 4) Spike noise can cause malfunction of the circuit. The recommended limitation of spike noise is no bigger than  $\pm 100 \text{ mV}$ .



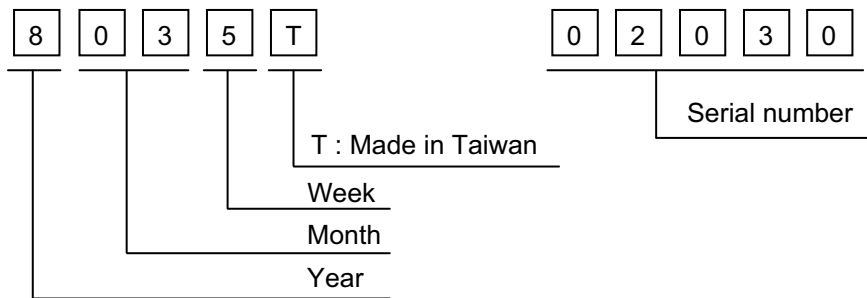
## 12.4 PRECAUTIONS of STORAGE

If the displays are going to be stored for years, please be aware the following notices.

- 1) Please store the displays in a dark room to avoid any damages from sunlight and other sources of UV light.
- 2) The recommended long term storage temperature is between 10 C° ~35 C° and 55%~75% humidity to avoid causing bubbles between polarizer and LCD glasses, and polarizer peeling from LCD glasses.
- 3) It would be better to keep the displays in the container, which is shipped from KOE, and do not unpack it.
- 4) Please do not stick any labels on the display surface for a long time, especially on the polarizer.

## 13. DESIGNATION OF LOT MARK

1) The lot mark is showing in Fig.13.3. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 5 digits are the serial number.



2) The tables as below are showing what the first 4 digits of lot mark are shorted for.

| Year | Mark |
|------|------|
| 2012 | 2    |
| 2013 | 3    |
| 2014 | 4    |
| 2015 | 5    |
| 2016 | 6    |

| Month | Mark | Month | Mark |
|-------|------|-------|------|
| 1     | 01   | 7     | 07   |
| 2     | 02   | 8     | 08   |
| 3     | 03   | 9     | 09   |
| 4     | 04   | 10    | 10   |
| 5     | 05   | 11    | 11   |
| 6     | 06   | 12    | 12   |

| Week (Days) | Mark |
|-------------|------|
| 1~7         | 1    |
| 8~14        | 2    |
| 15~21       | 3    |
| 22~28       | 4    |
| 29~31       | 5    |

3) Except letters I and O, revision number will be shown on lot mark and following letters A to Z.

4) The location of the lot mark is on the back of the display shown in Fig. 13.3.

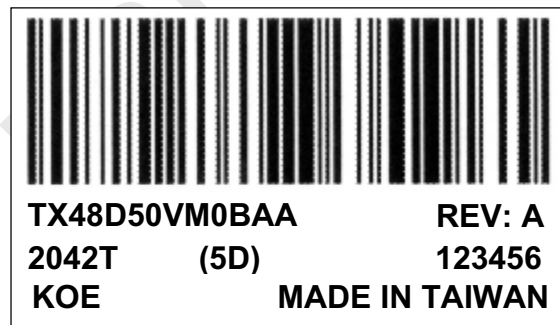


Fig 13.3